

IN THE SPECIFICATION:

Please substitute the paragraph starting at page 14, line 1 and ending at line 8 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A1  
--Preferred embodiments of the present invention will now be described in detail in accordance with the accompanying drawings. Each embodiment exemplifies a printhead designed to perform printing by using heat energy. Converting a plurality of binary data into multilevel data that can be transmitted over a signal line such as a bus will be referred to as "coding" hereinafter.--

Please substitute the paragraph starting at page 19, line 18 and ending at line 26 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A2  
--In this embodiment, the arrangements of printing elements and functional elements for driving them are the same as those in the first embodiment, but the layout of printing elements and block arrangement are designed to drive more printing elements without increasing the number of signal lines. The printhead of this embodiment has 352 printing elements x 2 rows, i.e., a total of 704 printing elements, and can drive the printing elements in the respective rows under different conditions.--

Please substitute the paragraph starting at page 20, line 7 and ending at line 17 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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75  
--The printhead includes, for each of two rows, an arrangement comprised of 352 printing elements 1, a driver block 2 for driving the printing elements in one row, AND circuits 3 for determining driving conditions for the respective printing elements, a 3/8 coder 5 for decoding a code for designating a block, a 3-bit latch 4' for holding a 3-bit signal input to the decoder, a 4-bit shift register 4 for sequentially holding input 4-bit data signals, a 44-bit latch 8' for holding printing data for the 44 printing elements in a block, and a 4 x 11-bit shift register 8 for sequentially holding 11 input 4-bit data signals.--

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Please substitute the paragraph starting at page 22, line 6 and ending at line 12 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A4  
--The second printing control signal generated in the circuit includes BLK outputs B0 to B43. Each output can simultaneously activate eight printing elements. For example, the output B0 controls the printing elements indicated by Seg numbers 1, 3, 5, 7,..., 15, and the output B1 controls the printing elements indicated by Seg numbers 2, 4, 6, 8, ..., 16.--

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Please substitute the paragraph starting at page 22, line 13 and ending at line 25 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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NS --By combining the ENB outputs from the 3/8 coder 5 and BLK outputs, which can be arbitrarily selected, in this manner, the 352 x 2 (rows) printing elements connected to the two blocks can be arbitrarily turned on/off. By forming a raster image on the printing apparatus side in accordance with this regularity, printing control data can be transferred to the printhead at a high speed. In this embodiment, printing control data for the two printhead rows are continuously input to DATA [3..0] terminals. Note that since block designation data input to the 3/8 coder 5 in this embodiment consists of 3 bits, one bit of DATA 3 is masked. If, however, the number of divided blocks or printing elements increases, this signal can also be used.--

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Please substitute the paragraph starting at page 26, line 22 and ending at page 27, line 3 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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HP --Such a circuit arrangement of this embodiment on the semiconductor substrate for the printhead is shown in Fig. 7. The arrangement shown in Fig. 7 differs from the arrangement shown in Fig. 3, in the layout of the 4-bit shift register for receiving the block selection data, in the shift register 8 for receiving the image data, and in the number of printing elements 1. However, the other basic arrangement shown in Fig. 7 is similar to that of Fig. 3.--

Please substitute the paragraph starting at page 27, line 4 and ending at line 12 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A7  
--Fig. 8 shows a detailed circuit arrangement in part of the semiconductor substrate for the printhead. Similar to Fig. 7, the arrangement shown in Fig. 8 differs from the arrangement shown in Fig. 4, in the layout of the 4-bit shift register for receiving the block selection data, in the shift register 8 for receiving the image data, and in the number to printing elements 1. However, the other basic arrangement shown in Fig. 8 is similar to that of Fig. 4. And timings of the data transfer are shown in Fig. 9.--

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Please substitute the paragraph starting at page 27, line 13 and ending at line 17 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A8  
--Note that the positions of circuits for controlling the image data group and the block selection data group are arbitrarily set within the semiconductor substrate in accordance with the arrangement of the corresponding printhead.--

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Please substitute the paragraph starting at page 32, line 10 and ending at line 17 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A9  
--According to this embodiment, since the numbers of shift registers 4 and 8 can be decreased with respect to the total number of printing elements, the circuit arrangement can be simplified, and the chip size can be reduced. In this embodiment, the number of control signals (terminals) is three. As in the second embodiment, data is transmitted over a bus, and a further increase in transfer rate can be attained.--

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Please substitute the paragraph starting at page 36, line 12 and ending at line 26 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A10  
--Although the arrangement of a printing apparatus using the printhead of the present invention will be described later, if an integrated circuit for arbitrating printing control signals is mounted on a carriage on which the printhead is mounted, information for the printhead can be communicated as well as printing control signals. For example, the function of checking a temperature sensor and the like on the printhead can be encoded, and the resultant register value is mapped on the integrated circuit. Alternatively, an image data pattern or grayscale printing data can be encoded and the timing of feedback control for them can be encoded. A circuit on the printhead is preferably capable of directly handling these encoded data to directly convert the data into driving control data for printing elements.--

Please substitute the paragraph starting at page 42, line 10 and ending at line 16 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A11  
--As described above, since encoded printing control data are sequentially transferred to the printhead of the present invention, these processes can be sped up, and the throughput can be improved. Signal lines containing encoded data generated by the raster image control unit 1720 are directly connected to the printhead 1726 via the connection portions 1723 and 1724.--

Please substitute the paragraph starting at page 45, line 12 and ending at page 46, line 1 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A12  
--As described above, the scheme of performing printing control on the basis of a communication protocol will greatly influence the forms of future printing apparatuses. More specifically, by encoding printing control signals, the substantial number of connection terminals between the printing apparatus body and the printhead can be reduced, and high-speed data transfer can be implemented. This makes it possible to reduce the communication load and further simplify the arrangement of the apparatus as a direct printer. Since communication protocols that define higher transfer rates have increased in number, the processing speed of a printing apparatus can be effectively increased by using this communication method.--

Please substitute the paragraph starting at page 52, line 3 and ending at line 13 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A13  
--Further, the storage medium, such as a floppy disk, a hard disk, an optical disk, a magneto-optical disk, CD-ROM, CD-R, a magnetic tape, a non-volatile type memory card, and ROM can be used for providing the program codes. Furthermore, additional functions according to the above embodiments are realized by executing the program codes which are read by a computer. The present invention includes a case where an OS (operating system) or the like working on the computer performs a part or an entire process in accordance with designations of the program codes and realizes functions according to the above embodiments.--

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Please substitute the paragraph starting at page 52, line 14 and ending at line 22 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

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A14  
--Furthermore, the present invention also includes a case where, after the program codes read from the storage medium are written in a function expansion card which is inserted into the computer or in a memory provided in a function expansion unit which is connected to the computer, a CPU or the like contained in the function expansion card or function expansion unit performs a part or entire process in accordance with designations of the program codes and realizes functions of the above embodiments.--

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IN THE ABSTRACT:

Please substitute the paragraph starting at page 63, line 2 and ending at line 12 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

AIS  
--The disclosed printhead can speed up transfer of image data and driving of printing elements without increasing the number of signal lines and connection terminals. An image data signal supplied to the printhead has a 4-bit bus format containing block selection data in its head. This signal is separated by a selection signal, and only the block selection data contained in the head is held in a latch and supplied to a decoder. The 4-bit image data corresponding to the four subsequent segments are respectively held in the four latches of a first printing control unit.--

IN THE CLAIMS:

Please amend the claims to read as follows. A marked-up version showing the changes made to Claims 1 through 3, 5 through 11, 13 through 15, 17, 18, 20 through 40 and 42 through 44 is attached. For the Examiner's convenience, all of the pending claims have been reproduced below.

Sub B1  
1. (Amended) A printhead comprising:

a plurality of printing elements for printing;